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clopropane, or by a combination of these causes. Controlled respiration, which implies the occurrence of apnoea in accordance with these principles, has been developed in recent years mainly as a solution to two problems in inhalation anaesthesia: the production of relaxation with cyclopropane, and the control of the respiratory disabilities which complicate thoracic surgery. . . .

"The controlled-respiration technique greatly enlarges the clinical usefulness of cyclopropane, but this does not justify the use of this agent in cases more satisfactorily dealt with by non-inhalation methods, e.g. in the muscular patient requiring profound relaxation over a long period and for whom local or spinal analgesia is not contra-indicated. Crafoord has pointed out that the muscles of respiration are put completely at rest during this type of anaesthesia. This is in complete contrast to the laboured movements and active expiration usually associated with semi-closed methods. The possible influence of each of these factors on the occurrence of post-operative pulmonary complications is worthy of investigation. Further blood-carbon-dioxide studies during controlled respiration would also be of interest. In the present state of our knowledge it would seem that the minimal amount of anaesthetic which will produce satisfactory operating conditions is, in the majority of cases, the best amount to use. This is true for controlled-respiration anaesthesia, and inadvertent overdosage through failure to estimate depth correctly may be one of the causes of some of the untoward post-operative circulatory effects. . . . There can be no doubt that efficient controlled respiration is wholly preferable to inadequate spontaneous ventilation, and offers an effective solution to difficulties which often arise from this cause during inhalation anaesthesia." 13 references.

J. C. M. C.


"To-day there is an increasing emphasis on the rehabilitation of the patient after operation. . . . At the outset of his career, the attention of the anaesthetist is focused almost entirely on the actual administration during operation. With increasing experience he should be able not only to provide satisfactory operating conditions for the surgeon, but also to keep constantly in mind the convalescent period and end-result. A prophylactic attitude can do much to prevent or minimize complications; and its cultivation is of the first importance. The application by the anaesthetist of a special knowledge of post-operative complications should benefit the patient, help the surgeon, and bring a wider interest to the specialty." 22 references.

J. C. M. C.


"The discovery and final establishment of inhalation anaesthesia as an integral part of surgical practice was partly the inevitable outcome of scientific research, partly the result of vagaries of circumstances. Researches on pneumatic chemistry and the physiology of respiration during the seventeenth and eighteenth centuries prepared the way for Joseph Priestley's discovery of oxygen (1744) and for Lavoisier's elucidation of the nature of the respiratory process (1774-85). . . . Therapeutic inhalation was principally studied by the brilliant circle of men whom Priestley had drawn around him at Birmingham. In 1792 Thomas Beddoes . . . decided that pneumatic medicine ought to be systematically and intensively studied. . . . In 1798 Beddoes was looking for a superin-
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Tendent for the Pneumatic Institution and when, during a summer holiday at Penzance, a friend introduced him to the eighteen-year-old surgeon's assistant, Humphry Davy, whose chemical researches undertaken on his own account already marked him as a student of brilliant promise, Beddoes offered him the appointment at Clifton. Once installed, Davy set to work to complete an investigation, which he had already begun, on the physiological effects of nitrous oxide.

"After studying the literature of pneumatic chemistry (although apparently not Davy's monograph on nitrous oxide), Henry Hill Hickman, a young Shropshire general practitioner, came to the conclusion that the inhalation of carbonic-acid gas would harmlessly obtund the pain of surgical operations. During 1823 he proceeded to put his theory to the test in a series of minor operations performed on puppies, kittens and mice. . . . Despite the success of these experiments, an account of which he published in 1824, Hickman hesitated to apply his discovery to human beings without first gaining the support of other medical and scientific men. In this he completely failed. . . . In the early eighteen-forties . . . C. W. Long . . . [was] led to think that surgery might be painlessly performed on etherized subjects and in 1842 he proved this supposition correct when he removed three small tumours from the neck of a lad who had willingly consented to inhale.

"Wells was a dentist, living at Hartford, Connecticut, and in December, 1844, at a demonstration of the effects of inhaling nitrous oxide . . . he made a discovery similar to Long's . . . Wells induced Colton to let him inhale nitrous oxide so that a colleague might extract a tooth from him. The success of this operation led Wells to adopt the use of nitrous oxide in his dental practice. . . . Profiting by Wells's experience, W. T. G. Morton came to the conclusion that surgical anaesthesia was practicable, although not with nitrous oxide. The obvious alternative was ether vapour. . . . Morton succeeded, on 30 September, 1846, in painlessly extracting a tooth from Eben Frost. On that occasion the patient inhaled ether from a folded cloth. Morton hastened to arrange another demonstration at the Massachusetts General Hospital. On 16 October, 1846, Morton—this time using a valved glass flask containing an ether-soaked sponge—convinced the assembled surgeons that surgical anaesthesia could effectively be induced and maintained. . . . The news reached the physician Francis Boott at his house in Gower Street, London, in December 1846. . . . Boott immediately passed on the news to the surgeon Liston who, on 21 December, 1846, painlessly amputated a leg and removed a toe-nail from two patients who had inhaled ether. . . . In France, although news had come directly from America to one or two surgeons, it was not until January 1847, after accounts of many successful cases had appeared in the English Press, that J. F. Malgaigne was emboldened to try etherization for himself. . . .

"Ether itself was blamed for difficulties really attributable to faulty inhalers, and as early as 1847 many people had begun to look for a more manageable agent. When, in November, 1847, James Young Simpson, professor of midwifery at Edinburgh, announced that he had found it in chloroform and described how it could be administered simply by pouring it on to a folded cloth (some of his colleagues used the patient's nightcap or the worsted glove of an onlooker), the use of ether was quickly discarded. . . . From the outset English anaesthetic practice was distinguished from that of other nations by two features—the use and development of automatically-regulating inhalers and the
employment of specialists to administer anaesthetics. ... Prominent both as a designer of apparatus and as the first specialist anaesthetist was the physician John Snow, of London. ... As the number of deaths from chloroform mounted, more and more people, while continuing to use the drug for want of a better, anxiously awaited the discovery of some new agent combining potency and ease of administration with safety. ... Although the Americans continued exclusively to use ether given by the towel-cone method in general surgery, in 1863 they readopted the use of nitrous oxide for dental surgery. ... About 1870 one or two people in England made a tentative retrial of ether anaesthesia. ... Once the use of ether was firmly reestablished, ... the national preference for mechanical inhalers began to assert itself. ... 

"On the continent of Europe the development of nitrous oxide anaesthesia was interrupted by the Franco-Prussian War of 1870, and interest in it was not revived until 1878. Then the physiologist Paul Bert suggested that instead of the usual method of administering nitrous oxide undiluted with air, which meant that asphyxial symptoms inevitably appeared, 50% nitrous oxide and 50% air should be administered under a positive pressure of two atmospheres. ... Bert then proposed the use of oxygen with nitrous oxide at normal pressure. This had already been tried by Andrews of Chicago, in 1869. ... During the eighteen-eighties the Copenhagen surgeon Wanscher introduced the use of ether. ... In 1884 the ophthalmic surgeon Carl Koller reported his successful use of a solution of cocaine in anaesthetizing the cornea, and soon cocaine was being widely used, both painted on mucous surfaces and injected hypodermically. The method of infiltration anaesthesia developed first by Reclus in Paris about 1886 and then by Schleich in Berlin about 1891, was the only one to become firmly established before the close of the nineteenth century. Nevertheless the American surgeon Halsted had already laid the foundations of regional anaesthesia when, during the winter of 1884, he dissected out the brachial plexus, having first blocked the nerve-roots in the neck with cocaine solution; and the neurologist Leonard Corning, of New York, had shown in 1885 that spinal anaesthesia was practicable." 73 references.

J. C. M. C.


"On 21 December 1846, a major operation was performed under general anaesthesia for the first time in England. After nearly a hundred years it seems appropriate to review the progress and present practice of anaesthetics in this country. ... Of anaesthetic agents, ether—the first to be employed in this country—remains the most popular. ... Chloroform is still used in some cases where there may be risk of explosion from the diathermy cautery. ... Ethyl chloride is widely regarded as being unnecessarily dangerous, but it is still used, because of its rapid effect. ... Vinyl ether (vinesthene) is not much used because of its high cost, though it is greatly superior to ethyl chloride in similar procedures. ... Trichlorethylene (trilene) has been given an extensive trial but is not generally accepted. ... Ethylene has not been used to any extent since the introduction of cyclopropane. ... Nitrous oxide is the agent most commonly used for minor dentistry and for other minor operations in ambulatory patients—always with oxygen. ... Thiopentone (pentothal) has largely replaced hexobarbitone (evipan). Some anaesthetists use it for all types of